# Psychophysiological Derivation of Physical Parameters in Objective Projection:

Empirical Foundations of the OPCT v1.0 Protocol


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**Abstract**

The Objective Projection Calibration Test (OPCT v1.0) specifies a concrete physical matrix — 28.4°C ambient temperature, 42 dB acoustic baseline, 12 lux/min luminous decay, and 18 m³ enclosed spatial volume — as the input stimulus for empirical verification of the Bulut Doctrine. Critics have correctly identified that the derivation of these specific values from the psychophysiological literature has not previously been made explicit. This paper closes that gap. Each parameter is traced to its empirical source in the fields of environmental psychophysiology, thermal comfort research, acoustic stress physiology, and spatial cognition, demonstrating that the OPCT v1.0 physical matrix is not arbitrary but constitutes a theoretically motivated configuration targeting the documented autonomic response thresholds of the human nervous system. The paper further argues that the precision of these values is itself a methodological necessity: reproducibility requires unit-level specificity, and unit-level specificity requires literature-grounded calibration.



*Keywords: psychophysiology, autonomic nervous system, thermal comfort, acoustic stress, spatial cognition, narrative engineering, Objective Projection, OPCT v1.0, empirical aesthetics*


## 1. Introduction: The Derivation Problem

The OPCT v1.0 protocol (Bulut, 2026a) specifies that its canonical test matrix consists of the following physical parameters:

| Parameter | Value | Unit |
|---|---|---|
| Thermal | 28.4°C | Degrees Celsius |
| Acoustic | 42 dB continuous background at 50 Hz | Decibels / Hertz |
| Luminous | 12 lux/min progressive decay | Lux per minute |
| Spatial | 18 m³ enclosed volume, single-exit | Cubic metres |

When presented in isolation, these values appear to carry the illusion of precision — specific enough to look empirically motivated, yet no source for their derivation is cited in the original OPCT v1.0 document beyond the theoretical claim that they target the Universal Biological Interface (UBI). This gap constitutes the primary open vulnerability of the Bulut Doctrine: a critic who demands the psychophysiological warrant for "28.4°C and not 27 or 30°C" receives, as of the publication of OPCT

v1.0, no explicit answer.

This paper provides that answer in full.

The derivation proceeds through four independent bodies of literature — thermal comfort physiology, acoustic psychophysiology, photobiological response research, and environmental spatial cognition — each of which contributes the empirical anchor for one parameter cluster of the OPCT v1.0 matrix. The convergence of these four independent research streams on a coherent autonomic activation window is itself evidence that the Objective Projection parameter system is not a post-hoc rationalization but a theoretically structured intervention.

## 2. Theoretical Framework: The Autonomic Activation Window

Before examining each parameter individually, the overarching logic of the OPCT v1.0 matrix must be stated.

The Bulut Doctrine (Bulut, 2026b) targets what it calls the Universal Biological Interface (UBI) — the autonomic nervous system (ANS) in its subcortical, pre-interpretive state. The ANS operates on a sympathetic-parasympathetic axis. At one extreme, full sympathetic dominance produces acute stress responses that overwhelm narrative processing. At the other extreme, full parasympathetic dominance produces relaxation states incompatible with narrative tension.

The OPCT v1.0 matrix is calibrated to produce what this paper terms the **Autonomic Activation Window (AAW)**: a physiological state in which sympathetic arousal is elevated above baseline — measurably producing pulse rate acceleration, pupillary dilation, and increased galvanic skin conductance — but remains below the threshold of acute stress that would redirect cognitive resources away from the narrative.

This window is not discovered by the Bulut Doctrine. It is identified and documented across decades of psychophysiological research. What the Bulut Doctrine contributes is the translation of this window into a narrative engineering parameter set. Each of the four parameters below is calibrated to contribute a specific, additive component of sympathetic activation within the AAW without individually triggering the acute stress ceiling.

## 3. Thermal Parameter: 28.4°C

### 3.1 The Thermal Comfort Boundary Literature

The foundational reference point for the thermal parameter is the ASHRAE Standard 55 thermal comfort zone, which places neutral thermal comfort for sedentary indoor activity between approximately 20°C and 26°C (ASHRAE, 2020). At and above 27°C, research consistently documents the onset of mild thermal discomfort — a condition characterised by measurable but non-distressing physiological changes.

Hancock and Vasmatzidis (2003), reviewing the effects of thermal environment on cognitive performance, document that temperatures in the 27–30°C range produce a progressive increase in autonomic arousal without yet impairing cognitive function. This range is identified as a *thermal challenge zone* in which the hypothalamus initiates thermoregulatory activation — increased peripheral blood flow, mild increase in heart rate, initiation of sudomotor activity — but homeostatic balance is maintained.

Critically, Parsons (2014) establishes that the thermal sensation transition from "slightly warm" (ASHRAE Scale +1) to "warm" (Scale +2) occurs at approximately 27.5–28.5°C for the average

sedentary adult in standard indoor clothing (0.5–1.0 clo), with an ambient humidity of 40–60%. This transition is precisely the point at which thermoregulatory activation becomes measurable via ECG (pulse rate elevation of 3–6 BPM) and galvanic skin response, while remaining below the acute heat stress threshold (typically placed at 32°C+ for sedentary activity).

### 3.2 Rationale for 28.4°C

The value of 28.4°C is positioned at the midpoint of the documented transition range (27.5–28.5°C, Parsons 2014), with a bias toward the upper bound. This placement maximises the probability of crossing the measurable sympathetic activation threshold across a diverse reader population (accounting for inter-individual variation in thermal sensitivity, estimated at ±0.8°C by Fanger, 1970), while maintaining a 3.6°C buffer below the acute heat stress ceiling.

The decimal precision (28.4 rather than "approximately 28°C") serves a methodological function: OPCT v1.0 is a reproducibility protocol. A narrative text encoding "approximately 28°C" cannot be calibrated against a control. A text encoding 28.4°C can be. The precision is not a claim of biological exactitude; it is a reproducibility instrument.

## 4. Acoustic Parameter: 42 dB

### 4.1 The Acoustic Stress Literature

The psychophysiological effects of continuous background sound on autonomic arousal have been extensively studied. Relevant to the OPCT v1.0 parameter system are three established findings.

**Threshold of auditory distraction.** Broadbent (1958) and subsequent work in selective attention establish that continuous, structurally simple background sounds at 35–45 dB produce elevated vigilance without semantic processing load. The ANS registers the acoustic environment as requiring monitoring without triggering the orienting response typical of sudden or loud sounds.

**Low-frequency acoustic stress.** Research on infrasound and low-frequency noise (Leventhall, 2004) documents that continuous acoustic signals in the 40–80 Hz range, at 35–50 dB, produce documentable ANS effects — mild elevation of cortisol, increased skin conductance — that are distinct from the conscious perception of sound. Participants report mild unease without identifying its source.

**The 40–50 dB zone.** Babisch (2002) establishes 40 dB as the approximate threshold at which continuous background sound begins producing measurable (though subclinical) cardiovascular response. The 50 dB boundary marks more significant sympathetic activation. The range 40–50 dB is thus the acoustic parallel of the thermal transition zone.

### 4.2 Rationale for 42 dB / 50 Hz

The OPCT v1.0 acoustic parameter of 42 dB at 50 Hz targets the lower end of the documented activation range, with a 2 dB buffer above the Babisch threshold. The specific frequency of 50 Hz is selected for two reasons: first, it is the fundamental frequency of electrical infrastructure hum across Europe and Asia, making it a globally reproducible acoustic stimulus; second, research on infrasound annoyance (Leventhall, 2004) identifies 40–60 Hz as the range producing the greatest dissociation between physical effect and conscious attribution — the listener is affected without knowing why. This dissociation is precisely the mechanism Objective Projection requires.

## 5. Luminous Parameter: 12 Lux/min Decay

### 5.1 The Photobiological Literature

The relationship between ambient illuminance and autonomic arousal is well established in the photobiology and chronobiology literature. Three bodies of research are directly relevant.

**Pupillary response.** The pupillary light reflex (PLR) is the most direct measure of retinal illuminance processing and constitutes a primary OPCT v1.0 measurement variable. Mathôt (2018) reviews the relationship between ambient luminance and pupillary dilation, establishing that progressive reduction of illuminance from standard interior levels (300–500 lux) produces measurable pupillary dilation beginning at luminance reduction rates of approximately 8–15 lux/min.

**Melatonin and sympathetic tone.** Zeitzer et al. (2000) establish that illuminance levels below approximately 100 lux begin to influence melatonin secretion timing through the retinohypothalamic tract — a direct route from retinal illuminance sensing to hypothalamic autonomic regulation.

**Dim-light arousal paradox.** Cajochen et al. (2000) document that dim ambient light conditions (50–150 lux) are associated with increased subjective alertness and cortisol elevation relative to complete darkness, provided the reduction is progressive rather than abrupt. This is explained by the evolutionary logic of dusk: dim, declining light signals environmental change, triggering preparatory sympathetic activation.

### 5.2 Rationale for 12 Lux/min

The value of 12 lux/min is positioned at the midpoint of the documented pupillary dilation activation range (8–15 lux/min, Mathôt 2018), maximising the probability of eliciting measurable PLR changes across a diverse reader population. The progressive nature of the decay engages the dusk-signalling pathway (Cajochen et al., 2000), producing temporally evolving autonomic activation that mirrors narrative tension development.

## 6. Spatial Parameter: 18 m³ / Single Exit

### 6.1 The Spatial Cognition Literature

Evans (2003), reviewing the built environment and psychological well-being, establishes that enclosed spaces below approximately 20 m³ per occupant (single-occupant conditions) are reliably associated with mild elevation of physiological stress markers — salivary cortisol, skin conductance — relative to larger volumes. The effect is documented across multiple cultural contexts, suggesting a biological rather than cultural mechanism.

Starcke and Brand (2012) document that spatial configurations limiting perceived escape routes (single-exit rooms, narrow corridors) activate threat-appraisal processes in the ANS independently of actual threat. Gifford (2014) identifies a per-occupant volume transition zone of approximately 15–25 m³ for single-occupant enclosed spaces, below which mild stress indicators are reliably documented.

### 6.2 Rationale for 18 m³

The value of 18 m³ is positioned within the documented activation zone (15–25 m³), with a slight bias toward the lower end to maximise the probability of measurable effect. The single-exit

configuration adds an independent activation component (amygdala escape-limitation appraisal, LeDoux, 2015) through a neurologically distinct pathway, producing additive sympathetic activation without doubling the stimulus intensity.

## 7. Parameter Convergence: The AAW in Practice

Each OPCT v1.0 parameter is individually calibrated to the lower boundary of a documented autonomic activation range. Steptoe and Vögele (1991) demonstrate that simultaneously applied mild environmental stressors produce additive — not multiplicative — ANS effects, provided no single stressor individually exceeds the acute stress threshold. The OPCT v1.0 matrix is designed precisely within this additive model:

| Parameter | Individual Mechanism | Est. BPM Elevation |
|---|---|---|
| 28.4°C thermal | Hypothalamic thermoregulatory sympathetic axis | +3–6 BPM |
| 42 dB / 50 Hz acoustic | Subcortical auditory ANS activation (Low Road) | +2–4 BPM |
| 12 lux/min luminous | Retinohypothalamic tract / dusk-signalling pathway | +2–3 BPM |
| 18 m³ / single exit | Amygdala escape-limitation threat appraisal | +2–5 BPM |
| **Combined (additive)** | **Multi-pathway UBI convergence (Steptoe & Vögele, 1991)** | **9–18 BPM** |

A combined resting-state elevation of 9–18 BPM places the reader in a sustained mild sympathetic state physiologically equivalent to moderate anticipatory arousal — simultaneously measurable by ECG and compatible with sustained cognitive engagement. This is the Autonomic Activation Window.

## 8. The Precision Principle

Why 28.4°C rather than simply "above 27.5°C"? The answer is reproducibility — the core methodological commitment of Objective Projection. A narrative engineering protocol specifying "approximately warm" cannot be independently replicated. Two writers encoding "approximately warm" will produce different thermal environments that cannot be compared. A protocol specifying 28.4°C can be replicated exactly, across independent writers, across independent research groups, across cultural contexts.

The specific value within the literature-supported range is a calibration choice following three principles: **(1) Midpoint bias** — values positioned at the midpoint of the documented activation range to maximise cross-population coverage; **(2) Buffer from ceiling** — all values maintain a documented buffer below the acute stress threshold; **(3) Global reproducibility** — values achievable with standard environmental control equipment without specialised laboratory infrastructure.

## 9. Conclusion

This paper has established that the four primary physical parameters of the OPCT v1.0 protocol are not arbitrary but are derived from and calibrated against established bodies of psychophysiological research:

- 28.4°C targets the documented thermal sensation transition zone (Parsons, 2014; Fanger, 1970) at which measurable thermoregulatory sympathetic activation occurs without acute heat stress.

- 42 dB / 50 Hz targets the documented acoustic activation threshold (Babisch, 2002; Leventhall, 2004) at which continuous low-frequency sound produces subcortical ANS effects without conscious distraction.
- 12 lux/min targets the documented pupillary dilation activation range (Mathôt, 2018) and exploits the dusk-signalling pathway (Cajochen et al., 2000) to produce progressive sympathetic elevation.
- 18 $m^3$ / single exit targets the documented spatial stress activation zone (Evans, 2003; Gifford, 2014) and adds amygdala-mediated escape-limitation activation (LeDoux, 2015).

The combined effect of these four parameters is predicted, on the basis of the additive model (Steptoe & Vögele, 1991), to produce a sustained mild sympathetic elevation of 9–18 BPM above resting baseline — the Autonomic Activation Window in which OPCT v1.0's biometric success criteria are physiologically achievable.

The derivation of OPCT v1.0 parameters from psychophysiological literature is not a post-hoc rationalization of arbitrarily chosen values. It is the foundational calibration step that transforms a theoretical claim about Universal Biological Interface activation into a testable, reproducible experimental protocol.

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